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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/736,724	12/13/2000	Shunpei Yamazaki	07977-175002	8339

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EXAMINER

BROCK II, PAUL E

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 06/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/736,724

Applicant(s)

YAMAZAKI ET AL.

Examiner

Paul E Brock II

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-- The MAILING DATE of this communication appears on the cover sheet with the correspond nc address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 June 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-73 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 3-20, 22-42, 51-56, 58-63, 65-67 and 69-73 is/are allowed.
- 6) ☒ Claim(s) 1, 2, 21, 43-50, 57, 64 and 68 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 December 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 08/912,979.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Claim Objections***

1. Claims 24, 30, 37, 38, 44, and 57 – 59 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim.

Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The subject matter of the noted claims do not further limit their respective parent claim and only serve to confuse the issue of what actually is being claimed.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 21, 43 – 50, 57 and 64 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. With regard to claim 21, the limitation starting on line 14: “wherein an impurity element that expands an energy band width (Eg) is added to said impurity region;” appears to be repetitious of the limitation defined on line five: “adding impurity elements that expand an

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energy band width (Eg) to said channel forming region.” It is not clear how these two limitations together further define the claim. It appears that the limitation starting on line 14 should be deleted.

5. It is not clear in claims 21 how the impurity region is formed. Is the recitation of “wherein an impurity element that expands an energy band width is added to said impurity region,” defining the addition of a second impurity into the impurity region? How many impurities are added to form the impurity region?

6. Claims 43, 50, 57, and 64 recites the limitation "said impurity element" in the first and second lines of the claim. There is insufficient antecedent basis for this limitation in the claim. For purposes of this office action “said impurity element” will be considered -- said impurity elements --.

### ***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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8. Claims 1, 2, and 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mase et al. (USPAT 6236064, Mase) in view of Mukai et al. (USPAT 5585658, Mukai) and Zhang et al. (USPAT 5403772, Zhang).

With regard to claim 1, it is inherent in the method of Mase that in order to implant ions into only parts of the channel formation region a mask has to be formed over a crystal semiconductor comprising a part to become a channel forming region. Further it is inherent in the method of Mase that a dotted hole would have to be formed in the mask. Mase discloses in figures 5a – 5c and column 5, lines 27 – 40 forming a substantially intrinsic region and impurity regions in the part to become the channel forming region by introducing a first impurity into the channel forming region having the dotted hole, the first impurity being oxygen. Mase also discloses in figures 5a – 5c and column 5, lines 27 – 40 introducing into the crystal semiconductor a second impurity that gives one conductivity to form a source region and a drain region in the crystal semiconductor with the channel forming region therebetween. It is inherent in the method of Mase that the impurity regions are formed through a mask over a crystal semiconductor. Mase does not disclose that the impurity region is formed through a resist mask with a dotted pattern that is patterned by the focused ion beam (FIB) method. Mukai discloses in figures 3a – 3e forming a resist mask (16) and patterning (17) the resist mask by using FIB method (18). It would have been obvious to one of ordinary skill in the art to use the resist and patterning using the FIB method of Mukai in the method of Mase in order to optimally control an impurity profile as discussed by Mukai in column 1, lines 54 – 58. Mase and Mukai do not teach the substantially intrinsic region has an oxygen concentration below  $2 \times 10^{18}$  atoms/cm<sup>3</sup>. Zhang teaches in column 9, lines 67 – 68 and column 10, lines 1 – 7 a substantially intrinsic

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region having an oxygen concentration less than  $10^{18}$  atoms/cm<sup>3</sup>. It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the concentration of impurity of Zhang in the method of Mase and Mukai in order to obtain a higher mobility as stated by Zhang in column 9, lines 67 – 68 and column 10, lines 1 – 7. Mase discloses in column 5, lines 27 – 40 that the impurity region occupies only parts of the channel formation region. Mase, Mukai, and Zhang do not disclose what percentage of the width of the channel region is occupied by the impurity region. It is well known in the art to have impurity regions that have a total width of  $W_{pi}$  in a direction of a width  $W$ , and a total of the intervals in  $W_{pa}$  in a direction of the width, wherein  $W_{pi}/W = 0.1$  to  $0.9$  and  $W_{pa}/W = 0.1$  to  $0.9$ . It would have been obvious to one of ordinary skill in the art at the time of the present invention to use percentage of the channel regions occupied by the impurity region of 10% to 90% in the method of Mase, Mukai, and Zhang in order to only occupy parts of the channel region so as to increase the carrier mobility of the charier region as stated by Mase in column 5, lines 27 – 40.

With regard to claim 2, Mase discloses in figures 5a – 5c forming a gate insulating film over the part to become the channel forming region after the step of forming the plurality of impurity regions. Mase discloses in figures 5a – 5c forming a gate electrode over the part to become the channel forming region with the fate insulating film therebetween.

With regard to claim 68, Mase discloses in column 4, lines 55 – 64, and column 5, lines 27 – 40 wherein the substantially intrinsic region contains boron, and concentration of boron therein is  $5 \times 10^{15}$ , and the substantially intrinsic regions contains oxygen, and concentration of oxygen therein is  $1 \times 10^{18}$ .

*Allowable Subject Matter*

9. Claims 3 – 20, 22 – 42, 51 – 56, 58 – 63, 65 – 67, and 69 – 73 are allowed.
10. Claims 43 and 51 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.
11. Claims 21, and 44 – 50 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action.

*Response to Arguments*

12. Applicant's arguments filed June 2, 2003 have been fully considered but they are not persuasive.
13. With regard to the applicant's argument "Claims 1, 2, and 68 are patentable since Mukai does not suggest at least one feature in these claims," one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Therefore, the applicant's arguments are not persuasive, and the rejection is proper.

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14. With regard to the applicant's statement that "Due to the amendments, the objection to claims 24, 30, 37, 38, 44, and 57 – 59... have been obviated..." the applicant is encouraged to further review the objection. The objection to the listed claims has not been overcome by the present amendment.

### *Conclusion*

15. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paul E Brock II whose telephone number is (703)308-6236. The examiner can normally be reached on 8:30 AM-5:30 PM.



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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703)308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7722 for regular communications and (703)308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

Paul E Brock II  
June 20, 2003



**EDDIE LEE**  
SUPERVISORY PATENT EXAMINER  
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